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Effect of the variation of visual materials on student learning via television

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EFFECT OF THE VARIATION OF VISUAL MATERIALS ON STUDENT LEARNING VIA TELEVISION

by

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INTRODUCTION

The function assigned to television in education depends upon an understanding of the structure of the media as a form of communication. The early use of television was simply as a convenient way to illustrate lectures or to demonstrate or present material to audiences in different localities at the same time. More recent experience has shown that this view is unduly narrow, yet very little systematic study has been done to elaborate a more complete conception of the structure of television communication. Without analysis of these there can be no full understanding of the educational objectives for which television may be uniquely or adjunctively appropriate.

The function of the video and audio channels of television may vary from being completely redundant to completely unrelated. A further use is to use a relationship between the two channels based on interest. The video portion used primarily as a means of maintaining interest and the audio channel used as the medium for transmitting the information.

The manner in which the video channel is used must be based upon the principles involved in graphics.

Any process of visual observance whether by the human eye or with a mechanical lens or viewer is fundamentally a process of selection, selection of a point or plane which is brought into focus and selection of the amount of light admitted to the sensitive recording surface. Even the casual glance

transmits only a limited aspect of a field of vision, either as vague imagery or in the form of a few features that happen for one reason or another to emerge from the total picture. When seeing ascends to the level of observation the process of selection becomes more intense.

Graphic materials may be usefully integrated with other visuals in order to increase their effectiveness in the preparation of a unit's study. A diagram can be used to emphasize a process observed in action in or out of the classroom. Animation can be included in motion pictures and television or slides to emphasize or explain complicated motion or motion that occurs at a rate impractical for direct reproduction.

The use of cartoons may be to illustrate dramatization or the emphasizing of material by making use of humor, fantasy, grotesquerie, incongruity, or satire. The logic of the cartoon lies in its implications or interest gathering ability; it touches the imagination which works like a sixth sense.

For the most part, cartoons in education have been applied to situations dealing with politics, social conditions, history, or economics chiefly because these examples are most readily available. Walt Disney and the Silly Symphony, along with many others, show that application can be made in areas of natural science, music, storytelling, reading, and many others.

Once television has been chosen as the media by which the information is presented there still exists many ways in which

it might be accomplished; one of these variables is the type of video that is presented.

Need for the Study

Television has excellent distributive powers for the material presented. It can expand instruction to many places simultaneously. It is, therefore, an excellent means of extending experienced teachers and above-average teaching resources to a larger number of students than would be possible under direct instruction.

Most of the studies of television effectiveness in education have been to compare televised teaching to "traditional" live classroom teaching. The results of these studies, as shown by subject matter testing, have varied from a significant difference in favor of "traditional" to those showing a significant difference in favor of televized instruction.

One of the hypothesized reasons for this variation of results is the method in which the material is organized and/or presented. A part of the presentation is the type of visuals used and the method used to present them. The purpose of this study was to investigate the effect of different visuals on learning via television.

Area of Study

This dissertation undertook to study the effect of four different visual presentations on learning by the students and

the effect of the different visual presentations on stratified groupings within each treatment and between treatments, Appendix I.

The information which was obtained would aid in answering the following questions:

a. Why does the comparison of learning via television and the traditional method often result in apparent contradictory results?

b. Does change in the visual channel of television affect learning and/or retention?

c. Does change in the visual channel of television affect learning and/or retention when treatment groups are stratified by college major, level of teaching preparation, sex, college grade point average, or ACT score?

d. Can learning be increased by inserting visual reinforcement statements and related thought questions?

This study was designed to reach the following objectives. These objectives gave the study direction and set the limitations within which the study would be carried out.

a. To determine the effect on the amount of material learned and/or retained by students which is attributable to the variation of the video part of three, twenty minute, video tape presentations.

b. To determine the effect on the amount of learning and/or retention between students with majors in elementary and in secondary education which is attributable to the method of video presentation.

c. To determine the effect on the amount of learning and/or retention between students enrolled in different colleges at Iowa State University which is attributable to the method of video presentation.

d. To determine the effect on the amount of learning and/or retention between students of different sex which is attributable to the method of video presentation.

e. To determine the effect on the amount of learning and/or retention between students having different grade point averages which is attributable to the method of video presentation.

f. To determine the effect on the amount of learning and/or retention between students having different ACT scores which is attributable to the method of video presentation.

Organization of the Study

This study was organized into six chapters. The first chapter includes the problem, need for the study and organization of the study. The second chapter includes a review of

literature pertinent to the study. The third chapter contains information pertinent to the experimental design. The fourth chapter contains the findings relevant to each stated hypothesis. The fifth chapter focuses on the discussion, conclusion, and recommendations. The sixth chapter summarizes the study.

Definition of Terms

In reviewing the literature various definitions have been found for which the meanings were not definite. To avoid ambiguity as well as to establish a framework of construction, a list of definitions of terms follows:

Audio is the sound portion of media, particularly in television and films.

Cartoons are visuals used to convey an indirect meaning, usually in a light context. They may include sketches of actual pictures.

Channel is the medium or media by which the material is presented to the learner.

Control group is the group of students not seeing or hearing the treatment, the non treatment group.

Covert response is a response which is not outwardly observable.

Cue summation predicts that learning is increased as the number of available cues or stimuli are increased.

Digital sign is the spoken or written name of the object.

Extroverted approach maintains that man functions under the impact of the outer world and that his ways of thinking about it and his image of it are dictated by the nature of that outer reality.

Iconic sign represents or is a symbol for a real thing, it may be audio or visual.

Introverted approach considers the outer world amorphous and subject to order and form as imposed upon it by the human mind.

Lecture is the presentation of the video portion, of television, done by keeping the camera constantly on the speaker.

Overt response is an observable response.

Stimulus generalization predicts that the information gained increases as the testing situation becomes more similar to the presentation situation.

Treatment is the particular video presentation by video tape, viewed by the participants in the study.

Typographical cueing involves the accenting of printed material such as by underlining or highlighting of the material.

Video is the visual portion of television.

Visual is the cartoon and/or slide or movie making up the video portion.

REVIEW OF RELATED LITERATURE

At least five main processes can be identified either in television content or structure which may affect the impact of the presentation on the learner and contribute to its instructional effectiveness: (a) rate of development, (b) repetition, (c) orientation, (d) audience involvement and (e) relation of pictures and sound. It was within the areas of the last two processes that this literature search was around.

Much of the earlier research was questioned by Travers and others (47) in a report which concluded that past audiovisual presentations had been designed without attention to a response-reinforcement model and that: (a) pictorial material included with printed material did little to aid retention of printed material, (b) in transmitting information through two sensory channels with redundant information, nothing would be gained for learning, (c) special effects were found to enhance learning consistently, (d) oversimplification could have a deleterious as well as a facilitating effect, (e) some verbalization with a film presentation was better than none, but there was an optimal amount, (f) verbalization of response and furnishing of knowledge of results appeared to be the most effective participation technique, and (g) film-mediated process such as the insertion of questions within a film still required further investigation in order to determine their usefulness.

Skinner (42) determined the effect of using a trained actor to perform as a good speaker and again as a poor speaker. The film version using the actor as a good speaker produced significantly higher immediate learning and retention of material than did the version using the actor as a poor speaker.

Perception

In order for learning to take place by either audio or visual presentation it must first be perceived by the learner who in turn must obtain the same information as was originally presented. The theories of perception help to give further insight into the method of most efficient learning.

Perception theory pertains normally to both communication and to learning. The subject of perception, as such has not received much attention in educational literature.

Gibson (10) first put perception into a logical perspective. It was not directly related to education but the implications were present. Gibson observed that perception was what enables one to identify objects and events when encountered. In order for these perceptions to be carried over to related situations in which the direct perception was not available a substitute stimulus must be present. These substitute stimuli might vary with respect to their degree of realism or the extent to which they actually duplicated the features of the original object. The substitute stimuli might be an exact

replica of the original or it might be an abstract symbol or a verbal stimuli. Gibson further observed that perception was different for different things. Based on past experiences perceived physical objects and places were identified or at least classified as to type. Gibson believed that this discrimination and identifying of things was an important part of learning. Much of learning must be accomplished by perceiving pictures, drawings, models, etc. and then correlating these perceptions to the real things. Gibson concluded that the more detail that was present in pictures the more realism there appeared to be, but that it might also increase the amount of irrelevant material that was present in the picture. Depending on the past experience of the observer, and the learning situation, an outline sketch might be of more aid in learning than a photograph.

Travers (46) agreed with Gibson that realism was not needed for perception to take place. Travers suggested that the nervous system was not effective in dealing with the environment in all of its detail and that it handled this through a process of simplification. Often detail added to an illustration inhibited perception of the true message rather than aiding it.

Norberg (33) stated that visual education assumes that people learn from what they see and that visual experiences influence behavior. Norberg hypothesized that: (a) what is

perceived is not determined by objective or environmental conditions, in their own right, (b) what is perceived is not determined by the physiological stimulus pattern, and (c) given objective conditions and associated retinal stimulation the observer perceives whatever represents, for him, the most likely prognosis for action based upon his experiences. Perceiving then must be considered in the context of purposeful behavior, and what is perceived is determined by the directive for action which reflects some set of assumptions as to what would happen if it had been carried out.

Spaulding (43) studied the interpretation of illustrations by young adults of Latin America and Mexico. The number of years that the participants had spent in formal schooling was quite low although the average age was eighteen years. Spaulding concluded that: (a) for an illustration to be of educational value it must be presented in terms of the past experience of the individual observer, (b) to communicate ideas the number of separate actions required to interpret the illustration should be kept at a minimum, (c) color may distract from the communication potential of drawings, and (d) captions should usually not be used to explain an illustration but rather to generalize.

Fearing (8) concluded that all communication produced between humans was steered by items which act as stimuli. The meaning that these items had and the direction that they

steered might vary from one individual to another depending on the homogenity of their experiences. Thus in order for communication to occur the individual who produced the stimuli must be able to respond to it in the same manner as the recipient was expected to respond. Communication was not simply a transmission system. Perception then became not merely photographic but was perceived in terms of the perceiver. What might act as a stimuli to one individual might not act as a similar stimuli to another individual. Fearing suggests that symbols may function in various ways: (a) they may point the direction by having an object, premise, or act, (b) they may generalize by placing it in a category or (c) they may act as a substitution of the real objects.

Arnheim (1) delved further into the contribution of sensory experiences on learning and understanding and supported the extroverted approach. Arnheim criticized the introverted approach in that it did not recognize the fact that the external world had a structure which steered the organizational process of the brain field through the mediation of visual stimulation.

In order for learning to take place through visual perception, Arnheim states that they must fulfill certain requirements. The picture must steer perception at the level intended. This can be accomplished by shape of contours, contrast or structure of the over-all pattern. The picture does

not present the object itself but is a set of propositions about the object.

Hochberg (19) studied picture perception based on measurable physical features of the objective stimulation and concluded that pictorial communication of shape and form was not simply a learned visual language. The communication of shapes was based on perceiving of edges and surfaces. Hochberg observed that nineteen month old children who had received no instruction or training concerning pictorial meaning could identify objects from outline drawings or silhouettes.

Toch and MacLean (45) took a transactional view to communication and perception. Communication is exemplified by the common experiences that humans have. When there exists a difference in experience then communication becomes difficult. Tock and MacLean observed that the more complex a perceptual situation became the greater the tendency for variation in the perception to occur. That to be most effective, from a learning atmosphere, visuals should present things simply and relevantly and with functional viewpoints and context.

Carlson and Carr (5) studied subjects using vision alone, vocality alone, and vision and vocality together to learn words. Some subjects were found to be consistently superior using one of the above methods than using another. Each treatment had groups of subjects that did better under that particular treatment, vocal, vision, or vocal and vision, than under

the other treatments. Carlson and Carr hypothesized that the subjects differed in their ability to use visual, vocal, and visual-vocal cues and that this hypothesis might then account for some of the conflicting reports as to the learning efficiency of different senses.

Multiple Channel Presentations

Television normally presents at least two channels, visual and audio. The material presented over these channels may supplement, compliment, or be redundant to each other. The learning which takes place may be affected by many variations of the two basic channels such as overt or covert response, cueing, active participation and the method of organization.

Hoban and Van Ormer (18) noted that the sensory channel by which the information was received did not alone determine the nature of the response but was only a starting point. The learner might translate it to one or more other channels before or during interpretation and understanding.

Hartman (15) investigated the possibility of predicting differences in the amount of learning taking place when the information was presented over single and/or multiple communication channels. He based his predictions on two hypotheses:

(a) Multiple channel presentations do not produce more learning than single channel presentations when the situation in which the learning is elicited also contains the additional cues.

(b) Redundant information simultaneously presented by the audio and print channels is more effective in producing learning than is the same information in either channel above.

Two theoretical positions used to predict the outcome were:

(a) Cue summation theory which predicts that learning of discrimination is increased as the number of available cues or stimuli is increased.

(b) Stimulus generalization - 'iconicity' theory - "learning" of presented information increases as the testing situation becomes more similar to the presentation situation.

Ausubel (2) studied the effect of relevant subsumming concepts on learning of material and its retention. He concluded that learning was facilitated in two different ways when organizers were used. First, they drew upon and used whatever relevant subsumming concepts were already established in the learner's cognitive structure and made it a part of the total learning. This rendered the new material more familiar and meaningful and the most relevant ideational antecedents were selected and utilized in an integrated fashion. Second, the organizer provided an anchorage for the learning; it promoted initial learning and retarded obliterative subsumptions.

Ausubel and others (3) concluded that retroactive inhibition is important in forgetting only when artificial situations employing nonsense learning tasks are involved. That in most

classroom learning situations subsequent study of relevant subsumming material resulted in only negligibly more forgetting than when the original material interacted spontaneously with established subsumming concepts already familiar to the learner.

Severin (40) studied learning of nonredundant material by use of multiple channels and concluded that learning gains could only be expected when the information on the two channels, but especially the picture, were also present in the subsequent recognition test. Based on cue summation Severin predicted and his results supported that audio plus related pictures would show the highest amount of learning and because of lack of cue summation audio plus print would not be significantly better than print alone. Severin concluded that multiple channels were superior to single channel communication when the relevant cues were summated across channels and that an increase in the number of cues available in the communication of information increased the amount of material learned, provided the cues were present in the test situation.

Van Mondfrans and Travers (49) investigated the use of two channels (audio plus visual) for learning of redundant information and concluded that the use of two channels had an advantage over one in learning of material which is redundant across channels.

Rohwer (36) studied 24 paired-associates in the form of pictures of objects or printed names of objects. When these were presented to elementary students along with verbalization they found that the pictorial presentation was superior to the printed word material.

Cooper and Gaeth (6) concluded that the visual presentation of noun material provided for superior performance by fourth, fifth and sixth grades while the same treatment produced inferior results, when compared to audio, in tenth and twelfth grades. They concluded that at some point in language development there ceases to be a distinction between channels and that any difference was a function of the learner's experiences rather than a function of the difficulty of the material.

Knowlton (28) distinguished between the sensory channels which received the information and the types of sign vehicles, iconic and digital, employed in the presentation. From this he concluded that the relationships of information in multiple-channel presentations were combinations of sign vehicle type and sensory channels. An example would be: (a) iconic, audio - moo, visual - line drawing of a cow, and (b) digital, audio - spoken word moo, visual - the printed word cow. If both audio and visual were the same type then they would be redundant.

Severin (39) studied the effect of printed, audio, and visual channel combinations and concluded that audio with

related pictures was significantly better than audio and print which was not significantly better than print alone because of the absence of cue summation. This supported Severin in his joining of the concept of stimulus generalization and cue summation into one hypothesis that an increase in the number of cues available in the communication of information increased the information gain, provided that the cues were also available in the situation where the gain was tested.

Because of the irrelevant cues introduced, the combinations of audio and unrelated picture were the poorest but for reasons unknown the most irrelevant cues resulted in greater recall than when cues with lesser degrees of irrelevancy were used.

Neu (32) did further investigation into the effect of relevant and irrelevant cues in both the visual and audio portion of training films which were shown to Army and Navy participants. There were five films developed: (a) basic; contained no experimental emphasis devices, (b) visual relevant; contained attention-gaining devices in the visuals that were related to the points of content being emphasized, (c) visual irrelevant; contained attention-gaining devices in the visuals that were unrelated to the points which were emphasized, (d) sound-relevant; contained attention-gaining devices in the sound tract that were related to points being emphasized and (e) sound-irrelevant; contained attention-gaining devices

in the sound tract that were unrelated to the points being emphasized. Neu found that substantial learning took place during the viewing of all films. Of the treatment groups, the sound irrelevant group had the lowest mean score in each population; however, the visual irrelevant version was the most effective of all of the versions which contained attention devices for the Army population. In the Navy population the two relevant attention devices were most effective while in the Navy test the basic version was consistently more effective. Neu observed no significant difference between the audio or visual channel as far as attention gaining devices.

Ulrich (48) studied the effect of the addition of visuals to a kinescope lecture shown to eighth grade students. Ulrich concluded that those viewing the kinescopes learned more than the control group which did not view the kinescope and that those viewing the kinescope with the added visuals learned significantly more than those viewing the lecture kinescope.

The Effect of Covert and Overt Responses

The response made by the learner to visuals are several. The learner might identify himself with a character and "experience" what is represented in the film as his own or the result of the anticipation of what he is looking for. The audience involvement may be as an overt response during the viewing or a covert response triggered by the overt response

or a direct covert response during the viewing.

Kishler (27) studied the effect of identification with college students and found no significant difference between those who identified and those who did not. Kishler's study consisted of two samples which differed in size by a factor of six.

Hovland and others (21) considered the effect of an overt vocal response on the learning of the phonetic name and the letter. The results concluded that the film version requiring an overt response produced larger gains in the amount of material learned and that the influence increased with increased difficulty of the phonics. Hovland attributed the increased learning to the ego involvement and to the motivation of an individual to learn in order to avoid a feeling of shame for poor performance in the eyes of his peers.

The Yale Motion Picture Research Project (53) concerned itself with the nonverbal overt response. The results indicated an increase in the amount learned when the test items covered directly the area covered by the participation film version but there was no gain when the test material covered items not specifically covered by the participation.

Roshal (37) was concerned with the effect of participation in films on perceptual-motor learning. The results of Roshel's study indicated no significant difference. A replication of the same type of experiment by Jaspen (22) allowed

for more development time within the film. This resulted in a longer time for participation by the learner. The results of Jaspen's study showed that the greater amount learned from the slow-rate-of development version, greater learner participation, was significant when compared to the amount learned from the rapid-rate-of-development version.

Goldbeck and Campbell (12) inquired into the relative efficiency of the overt and covert responses and observed that the efficiency of the overt response was quite low when compared to the efficiency of the covert and reading condition for both factual and continuous discourse learning. At the same time the performance, as measured by the amount learned, of the overt response failed to exceed that of the covert and reading group. There did appear to be an increase in the relative amount learned by the overt response as compared to the covert and reading response when the material to be learned was more difficult.

Suppes and Ginsberg (44) observed that six year old children who were required to correct their errors overtly learned more than children who were merely informed whether they had responded correctly or not.

Holland (20) working with college students observed that those students making overt responses to incomplete statements did significantly better than those who read the completed statements.

Krumboltz and Weisman (29) studied the effect of overt and covert responses in programmed instruction at the college level and concluded that the overt responses did not significantly affect learning when measured indirectly but that the overt response did aid in retention of material.

Roe and others (35) observed that students using a programmed text which required no overt response took significantly less time to complete the text and that their test scores were not significantly different from students using a program text requiring an overt response.

Silverman and Alter (41) studied the effect of overt response on college students and concluded that students who responded covertly did significantly better than did students who responded overtly. They did not, however, indicate the length of the study or its difficulty.

Evans, Glaser, and Homme (7) concluded that there was no significant difference between students giving an overt response and those giving a covert response but Evan's study used a very small number of students.

Insertion of Questions and Statements

The insertion of questions and/or statements in films or television may invoke an overt or covert response during the viewing. The exact effect may not be immediately visible and may vary with the viewer due to his past experiences.

Hoban (17) has suggested that within the concept of communication, motion pictures (like all media of communication and expression) serve to arouse and to pattern the perceptual responses of the learner, rather than to convey or transmit ready-made meanings from the teacher to the learner.

Jaspen (22) studied the effect of adding nomenclature to training films. The results indicated that there was little if any evidence that the addition of the nomenclature to the film increased the learning or retention of material. There also was no evidence that the nomenclature interfered with the learning or retention.

Hall and Cushing (14) used a slide projector to project questions onto a separate screen while high school students were viewing a film strip on an adjacent screen. Hall concluded that the addition of questions facilitated learning.

Brenner and others (4) studied the effects of inserting multiple choice questions or statements into a film. Six versions were shown: (a) the original film (no inserted questions or statements) shown once, (b) original film shown twice, (c) a large number of inserted questions, (d) a large number of inserted statements, (e) a moderate number of inserted questions, and (f) a moderate number of inserted statements. The comparison of the question and statement version was based on the hypothesis that the question version would stimulate more active participation and therefore more

learning. Their findings were not conclusive. The showing of the original film twice appeared to be as effective as the special film but there appeared to be a possible difference on the learning due to sex.

Hershberger (16) studied the relative effectiveness of typographical cueing and self-evaluational responding on learning and retention of both enrichment and essential lesson contact for both discursively and timely written tests. He concluded that irrespective of lesson topic, writing style, or reading ability self-evaluation reporting enhanced the learning and retention significantly more than typographical cueing and did not hamper the learning of non-self-tested material. The typographical cueing did reduce the amount of unimportant material the reader learned and its overall efficiency and rate of learning was at least equal to that of the self-evaluation.

Goldbeck (11) found that with junior high school students those who read the frames of a self instruction lesson learned more, on easy items at least, than did those students who were required to write the same response, the overt group. The efficiency of the implicit response group was also much greater.

Williams (52) studied the possibilities of ensuring active participation by use of student constructed response, answering multiple choice, underlining in the written material, and simply reading with no emphasis. Williams concluded that when using printed material the use of constructed response produced a significant gain in material learned when compared to

multiple choice, emphasis, and direct reading. The other responses increased learning in the order given.

Samuels and Jeffrey (38) observed the effect of letter cues, on the learning of paired associated words and concluded that the identification of words based on a single letter increases with dissimilarity of the stimuli when letters unsimilar to English letters made up the words.

Kaess and Zeaman (23) studied the effect of overt response on multiple choice type questions and concluded that there was no significant difference between college students who observed the correct answer and those who observed the correct answer and pushed the button on a punch board.

Vuke (51) studied the insertion of questions in a seventh grade science film. The comparison was between a ten minute film which contained inserted questions and another version which contained no questions. No significant difference in the amount of material learned or retained was observed between the two viewing groups.

Grosslight and McIntyre (13) did exploratory studies in the use of pictures and sound in teaching Russian vocabulary. They observed that overt participation in the form of pronouncing the words interfered with learning. When sound was added as part of the pictorial treatment it produced no significant increase in learning and at times appeared to interfere with it. Grosslight and McIntyre also observed that the

addition of titles increased learning significantly when used with motion pictures and still pictures.

Kale (24) studied the relative effectiveness of different presentations on learning of Russian. Kale's results differed from those of Grosslight and McIntyre in that it was observed that overt responses with sound pictures were as effective as sound pictures. Sound pictures were observed to be significantly better than still silent pictures. Kale observed that these differences had all disappeared in the retention test which was given one week later.

Kantor (25) investigated the effectiveness of adding questions to a film about seventh grade science. The questions were inserted prior to or after the content was covered. The results indicated that the insertion of the questions did not significantly increase the amount of material learned or retained.

Ketcham and Heath (26) studied the effect of using films which did not directly portray the subject matter. The study consisted of sound track only, sound and pictures, and face to face presentation in the learning of William Wardsworth. The film having visuals produced significantly more learning of material when compared to sound only.

Cartoon and Animation Form Versus Live Form in Films

The postulate that dramatic presentation is more effective because it contains factors of audience involvement may also be applied to the use of animated cartoons and live photography. The majority of the studies relating these comparisons were not based on two treatments of the same topic. Hence, they may not contain evidence on the value of cartooning as a presentation variable.

Gibson (9) compared an animated film in the form of an illustrated lecture to a specially prepared illustrated booklet and to a live community. The film produced by far the best results but Gibson made no effort to attribute this to the cartooning but to the relationships in action and the use of the subjective camera.

Richardson and Smith (34) found that the use of cartoons in health institutions produced more learning and enthusiasm than did printed pamphlets.

Lumsdaine and others (30) observed the influences of cartooning versus noncartooning in teaching by means of training films and found that groups observing the animated version learned significantly more. This was true for both above and below-average intelligence although the difference appeared to be greatest with lower ability learners.

McIntyre (31) studied the effect of inserting humorous elements in a training film compared to nonhumorous version with blank leader inserted over the humorous period and a third version which contained titles and sub heading in place of the humorous portion. McIntyre concluded from the study that the trainees learned significantly more from the film with titles than from the humorous approach and that there was no significant difference between the humorous and nontitled versions.

Vestal (50) working with high school physics students observed that those students viewing a nonanimated version did not make significantly higher gains than the animated version. However, when the samples were stratified by intelligence Vestal observed that those students reading in the upper quarter made gains, after viewing the nonanimated version, which were significantly higher than those viewing the animated version.

Summary

Theories of perception give an insight as to how visuals affect learning. These theories while still in the nebulous stage do help to indicate the conditions under which visuals may be expected to aid learning. There is some indication that as the visual becomes more complex the tendency for variation in what is perceived increases. This is compounded by the

differences in experiences between the people communicating.

There also exists a relationship between the visual and audio channels that is not well understood. Part of the differences that exist have been attributed to the presentation of redundant material over the two channels. Another factor that has been suggested as a possible cause for inconsistencies in research of multiple channel learning is that the cues used in the presentation must also be present when testing is taking place.

The effect of overt or covert response is not clear. Some of this confusion is possibly due to the incomplete understanding as to how participation enters into increased learning. Depending on the material presented or the individual learner the amount of involvement may actually be greater during a covert response than during an overt response. In general there is agreement that the covert response is the most efficient method with regard to time but not necessarily in regard to material learned.

Little research has been done to determine the effect of question and statement insertion as part of the visuals. The research results have been quite varied. Some of the variation has been attributed to the difference in the material being learned. There has also been a relatively consistent reporting of at least no interference in learning due to the insertion of questions or statements.

Animation and cartoon visuals have been used widely but very few research studies have looked at their effectiveness. The majority of the studies have indicated that more learning has taken place when animation or cartooning was used.

THE EXPERIMENTAL DESIGN

This study involved students in Education 204, "Foundations of American Education" at Iowa State University and students in Education 304, "Audio-visual Methods", at Winona State College. The same treatments were given to each group and comparison made within the institutions. The content of Education 204 was a general coverage of the American school system both past and future. It was the first course in the professional sequence leading to certification as a teacher. The content of Education 304 was a basic course in the operation of audio visual equipment and preparation of audio visual material.

At Winona State College the treatments were assigned to sections and the students were then randomly assigned to the treatments by means of a table of random number and all of the treatments were given at the same time. The students at Iowa State University were assigned to the sections by the registrar and the treatments then assigned to the sections by means of a random number table. The treatments were then given during the same day but at different times of the day.

Sources of Data

The data required to test the stated hypotheses were obtained from Education 204 classes at Iowa State University and Education 304 students at Winona State College. The records

from the respective institutions were used to obtain college grade point averages, ACT scores and colleges in which enrolled. The pretest, post-test, and retention test reliabilities were determined the summer prior to the start of the study through the use of the students enrolled in Education 204 at Iowa State University.

Delimitations of the Study

This study was limited to students enrolled in Education 204 at Iowa State University and those enrolled in Education 304 at Winona State College. The concern of this investigation was to study the effect of using the video portion of television as an interest maintaining element and also as a reinforcement element while the information was presented by the audio channel.

The Problem

This dissertation studied the effects of variation of the visual channel on the learning of material in a two channel television presentation, as measured by the difference in pretest and post-test scores.

Basic Assumptions

In order for the study to be meaningful, the following assumptions were made throughout the study:

a. The difference in times of day when the material was presented would not affect the results.
b. The material presented to the students after the video tapes would not bias the retention of these students during the rest of the quarter.
c. There would be no interaction of test material between students receiving different treatments.
d. The relationship between variables was linear.
e. The population was homogeneous.
f. The effects were additive.

Method of Treatment

Three twenty minute video tapes were prepared on the following subject areas which are normally covered in Education 204: (a) the effect of religion on education, (b) the effect of society on education and (c) the effect of industry on education.

The treatments consisted of four variations of the video part of the above tapes. The audio portion was the same in all tapes and was prepared by professional announcers at WOI-TV.

a. Treatment I: video of lecture.
b. Treatment II: video of lecture and important statements and appropriate questions.
c. Treatment III: video of cartoons.

d. Treatment IV: video of cartoons and important statements and appropriate questions.

e. Treatment V: no related material was presented between pretest and post-test.

Measuring Instruments

The pretest measuring instrument consisted of two parts. The first part consisted of twenty-five goals and objectives often found in a school's course of study or in recent news stories related to education. The students were then asked, which of four choices was the primary cause of its inclusion in a course of study or in the news. The choices were: (a) religion, (b) society, (c) industry or (d) other. The purpose of this test was to measure learning at the application level in Bloom's Toxonomy. The second test essentially measured straight recall and consisted of 41 multiple choice and true and false questions.

The post-test (Appendix II) consisted of the same questions as the pretest. This was done at the suggestion of testing services, at Iowa State University, in order to insure that the two devices were measuring the same thing.

The retention test was the same device as was used for the pretest, for the foregoing reasons. This test was given six weeks after pretest.

Evaluation of Measuring Instruments

The reliability of the measuring instrument was determined during the summer prior to the study. The treatment was presented to 49 Education 204 students enrolled in the second summer session at Iowa State University. The test was then administered to the students. The test was machine graded and an item analysis was done by the Iowa State University testing service. The results gave a test reliability for test one of 0.68 and a reliability of 0.76 for test two.

Design

The study consisted of five groups each containing approximately 75 students. At Iowa State University the treatments were assigned randomly to the section of Education 204 while at Winona State College the students were randomly assigned to the treatment groups. The material was presented over a one week span, three periods. The order within each treatment was:

Period I

a. pretest
b. video tape I

Period II

a. information survey
b. video tape II

Period III

a. video tape III
b. post-test

Assignment of Treatment

Because of the scheduling problems associated at larger institutions the students were assigned to the section by the registrar prior to the start of the study and the treatments then assigned to the sections. The sections were then handled as follows at Iowa State University.

Table 1. Treatment assignment

Section	Treatment no.	Time of day
G	1	8:00 am
C	2	2:00 pm
B	3	11:00 am
A	4	9:00 am
I	5	3:00 pm

All sections received a pretest, post-test, and retention test; a different treatment was presented to each of four sections while the fifth section received no treatment.

The same procedure was followed at Winona State College except that the students were randomly assigned to the treatments. And the testing and treatments were administered simultaneously to all sections. The size of each section was expected to be approximately 12 students.

The students at both institutions were asked not to discuss the treatment material with any of the other sections involved in the study. The instructors were also asked not to discuss the material other than as normally covered in the classroom.

Level of Significance

The level of significance used in literature was not found to be constant. The two levels occurring the most frequently were 0.05 and 0.01. The acceptance or rejection of the hypotheses in this study was made at the 0.05 level of significance.

Method of Statistical Analysis

The primary analyses used in the study were one way analysis of variance and analysis of covariance. The homogeneity within the various groupings of grade point averages, ACT scores and pretest scores was determined by means of one way analysis of variance. The homogeneity of these groupings was necessary in order to interpret the later comparisons.

The test of the remaining hypotheses all followed the general statistical model for analysis of covariance. The test included the effect of treatments on learning and retention, the effect of cartoons on learning and retention, the effect of questions and statements on learning and retention, and the

effect of stratification of sections by ACT score, level of teaching preparation, college grade point average, and sex, on learning and retention.

In order that individual differences could be largely reduced the post-test scores were adjusted by means of co-variance. After this adjustment the scores were then compared by means of an F test to see if there was a significant difference in the amount of learning and/or retention of material between treatment groups, within a school.

Hypotheses Tested

The following primary hypotheses were tested under the various groupings.

I. Ho: There is no significant difference among the means of treatment groups as to pretest I scores, pretest II scores, ACT scores, college GPA, post-test I scores, post-test II scores, retention test I scores, and retention test II scores.

II. Ho: There is no significant difference in learning among treatment groups receiving the information via television and those not receiving the information when the initial difference between groups is statistically adjusted.

III. Ho: There is no significant difference in retention among treatment groups receiving the information via television and those not receiving the information when the initial difference between groups is statistically adjusted.

IV. Ho: There is no significant difference in achievement, as measured by a post-test, of the groups of students taught by television when the video method of presentation is varied and the initial difference between groups is statistically adjusted.

V. Ho: There is no significant difference in retention, as measured by a retention test, of the groups of students taught by television when the video method of presentation is varied and the initial difference between groups is statistically adjusted.

VI. Ho: There is no significant difference in achievement, as measured by a post-test, between the combined groups when the video method of presentation remains constant and the initial difference between strata is statistically adjusted.

VII. Ho: There is no significant difference in retention, as measured by a retention test, between the combined groups when the video method of presentation remains constant and the initial difference between strata is statistically adjusted.

VIII. Ho: There is no significant difference in achievement, as measured by a post-test, between the stratified groups when the video method of presentation is varied and the initial difference between treatment groups is statistically adjusted.

IX. Ho: There is no significant difference in retention, as measured by a retention test, between the stratified groups when the video method of presentation is varied and the initial difference between treatment groups is statistically adjusted.

Model for Testing Treatment Effect between Groups

The effect of the variation of video treatments was measured by comparing the group means after they had been adjusted for the covariates.

$$Y_{a,i,1,2,3,4} = U + A_a + B_1c + B_2d + B_3e + B_4f + E_{a,i,1,2,3,4}$$

U = grand mean

A = fixed effect of the ath video treatment: a = 1,...,5

c = deviation of pretest I from its mean

d = deviation of pretest II from its mean

e = deviation of college grade point average from its mean

f = deviation of ACT score from its mean

B_1 = regression slope for pretest I

B_2 = regression slope for pretest II

B_3 = regression slope for college grade point average

B_4 = regression slope for ACT score

E = random error: $i = 1, 2, \ldots, n_a$.

Groupings to be Tested

The effect of treatments on learning, hypotheses II through V, were tested using pretest I and II scores, ACT score, and college grade point average as covariates and post-test I, post-test II, retention test I, and retention test II as measuring instruments.

In order to obtain a better understanding of the effect of the cartoons, the treatment effects were combined (Appendix III) into those not containing cartoons, treatment I and II, and those containing cartoons, treatment III and IV. These regroupings then formed the new treatments IA and IIA respectively. The next change was done to obtain a clearer understanding of the effect of the insertion of questions and statements. Treatments I and III which did not contain questions and statements were combined to form the new treatment IB and treatments II and IV were combined to form

treatment IIB. The control group remained unchanged, treatment V. Hypotheses II and III were tested under each of the above regroupings, IA, IIA and V and IB, IIB and V. Hypotheses VI and VII were tested for each combined grouping.

Under some learning conditions the amount of material learned or retained tends to vary with the treatment according to particular variates. In order to shed further light on this area the students within each treatment section were stratified (Appendix III).

Both of the above groupings were also used as treatment groups to study the effect of stratification. The stratification of sections by ACT scores was accomplished by grouping at less than 20, 20-40, 41-60, 61-80 and greater than 80 percentile rank. The stratification of sections by college grade point average was accomplished by grouping at less than 2.30, 2.30-2.59, 2.60-2.99, and greater than 2.99 grade points. The stratification of sections by level of teaching preparation was done by those preparing primarily for elementary, secondary, or other level of teaching. Hypotheses VIII and IX were tested for each of the stratifications using the model given below by changing the variate C to be equal to the stratification being tested.

Model for Testing Treatment Effect between Stratified Groups

A comparison was made between the strata within the same treatment and between like strata in different treatments for the effect of stratification and video treatment.

$$Y_{a,g,i,1,2,3,4} = U + A_a + C_g + (AC)_{a,g} + B_1c + B_2d + B_3e + B_4f + E_{a,g,i,1,2,3,4}$$

U = grand mean

A = fixed effect of the ath video treatment: a = 1,...,3

C = fixed effect of the gth stratified group: g = 1,...,5

(AC) = interaction of the ath video treatment effect and the gth stratified group effect

c = deviation of pretest I from its mean

d = deviation of pretest II from its mean

e = deviation of college grade point average from its mean

f = deviation of ACT score from its mean

B_1 = regression slope for pretest I

B_2 = regression slope for pretest II

B_3 = regression slope for ACT score

B_4 = regression slope for GPA

E = random error: $i = 1,2,\ldots,n_{a,g}$.

ACT score was not used as a covariate when treatments were stratified by ACT score. College grade point average was not used as a covariate when treatments were stratified by college grade point average.

FINDINGS

Each hypothesis was tested separately using students in Education 204 at Iowa State University and students in Education 304 at Winona State College, Winona, Minnesota. The students at Iowa State were assigned to sections by the registrar and the five treatments were then assigned to the sections by means of a table of random numbers. The students at Winona State were assigned to the treatments by using a table of random numbers. Throughout the study treatment V was used to indicate the effect of testing.

Three treatment groupings were studied at each college: (a) the original four video treatments plus a fifth group used to indicate test influence which did not receive the information tested over, (b) combining of treatments into those not seeing cartoons, those seeing cartoons, and those not receiving the information, and (c) combining of treatments into those not seeing questions and statements, those seeing questions and statements and those not receiving the information.

The number of participants completing the study (Table 2) varied from 21 to 50 at Iowa State and from 10 to 11 at Winona State. The combined groups (Tables 3 and 4) which were used to study the effect of stratification ranged from 68 to 75 at Iowa State and from 20 to 21 at Winona State.

Table 2. Number of participants per treatment group

	Treatment group								
School	I	II	III	IV	V	IA	IIA	IB	IIB
I.S.U.	50	21	25	47	40	71	72	75	68
Winona	11	10	10	10	10	21	20	21	20

The four video treatment groups scored higher on post-test II (Tables 5 and 6), after viewing the video tapes, than they did on pretest II. Video treatment II, lecturer plus questions and statements, produced the greatest increase at Iowa State while treatment III, cartoons, produced the largest increase at Winona State. When the groups were stratified (Tables 7, 8, 9, and 10), treatment group IA, lecturer, and treatment group IB, no questions and statements, produced the largest gains at Iowa State while treatment group IIA and treatment group IIB produced the largest gain at Winona State.

An increase in scores on post-test I over scores obtained on pretest I occurred at Iowa State with treatment II, lecture plus questions and statements producing the greatest increase. At Winona State there was a decrease in scores. Treatments III and IV, cartoons, produced the least decrease in scores.

Table 3. Number of participants per strata, Iowa State

	Strata																		
	GPA				ACT					Sex		College major				Level of prep.			
Trt.	I	II	III	IV	I	II	III	IV	V	I	II	I	II	III	IV	I	II	III	Total
IA	21	17	14	19	7	17	26	18	3	19	52	21	21	5	24	25	41	5	71
IIA	20	14	18	20	5	19	28	18	2	19	53	28	18	4	22	21	45	6	72
IB	19	24	18	14	6	23	26	18	2	19	56	29	21	5	20	29	41	5	75
IIB	22	7	14	25	6	13	28	18	3	19	49	20	18	4	26	17	45	6	68

Table 4. Number of participants per strata, Winona

	Strata														
	GPA				ACT					Sex		Level of prep.			
Trt.	I	II	III	IV	I	II	III	IV	V	I	II	I	II	III	Total
IA	7	5	8	1	12	4	4	1	0	9	12	8	13	0	21
IIA	2	2	9	7	4	7	7	2	0	7	13	11	8	1	20
IB	5	3	9	4	9	4	7	1	0	10	11	8	13	0	21
IIB	4	4	8	4	7	7	4	2	0	6	14	11	8	1	20

Table 5. Means, weighted means, and weighted standard deviations of variables in treatments I-V, Iowa State

Variable	Treatment mean					Combined treatment	
	I	II	III	IV	V	mean	st. dev.
Pretest I	15.76	14.71	15.12	15.87	15.63	15.55	2.68
Pretest II	21.50	20.62	22.56	22.98	21.80	21.99	4.29
GPA	2.65	2.74	2.63	2.68	2.53	2.64	0.58
ACT score	24.32	26.52	25.08	24.74	24.35	24.79	3.70
Post-test I	15.94	15.76	15.88	15.87	13.85	15.44	2.83
Post-test II	26.90	26.52	26.68	27.13	21.40	25.68	5.26
Ret. test I	15.88	15.05	14.88	16.13	14.42	15.39	3.22
Ret. test II	25.44	25.76	25.04	26.23	22.17	24.91	5.12

Table 6. Means, weighted means, and weighted standard deviations of variables in treatments I-V, Winona

Variable	Treatment mean					Combined treatment	
	I	II	III	IV	V	mean	st. dev.
Pretest I	15.20	15.45	16.10	16.40	15.60	15.75	2.42
Pretest II	19.20	18.55	20.20	20.80	22.00	20.18	3.45
GPA	2.43	2.55	3.06	2.71	2.79	2.70	0.48
ACT score	20.20	18.36	22.70	23.10	23.10	21.43	4.62
Post-test I	14.40	13.82	15.70	16.00	15.00	14.96	2.83
Post-test II	23.50	22.36	25.40	24.90	21.70	23.55	4.50
Ret. test I	14.80	14.36	14.30	16.00	15.50	14.98	2.85
Ret. test II	23.70	21.18	23.40	21.30	22.90	22.47	5.16

Table 7. Means, weighted means, and weighted standard deviations of variables in treatments IA, IIA, and V, Iowa State

Variable	Treatment mean IA	IIA	V	Combined treatment mean	st. dev.
Pretest I	15.45	15.61	15.63	15.55	2.68
Pretest II	21.24	22.83	21.80	21.99	4.29
GPA	2.67	2.66	2.53	2.64	0.58
ACT score	24.97	24.86	24.35	24.79	3.70
Post-test I	15.89	15.88	13.85	15.44	2.83
Post-test II	26.79	26.97	21.40	25.68	5.26
Ret. test I	15.63	15.69	14.42	15.39	3.22
Ret. test II	25.54	25.82	22.17	24.91	5.12

Table 8. Means, weighted means, and weighted standard deviations of variables in treatments IA, IIA, and V, Winona

Variable	Treatment mean IA	IIA	V	Combined treatment mean	st. dev.
Pretest I	15.33	16.25	15.60	15.75	2.42
Pretest II	19.00	20.50	22.00	20.18	3.45
GPA	2.49	2.88	2.79	2.70	0.48
ACT score	19.24	22.90	23.10	21.43	4.62
Post-test I	14.10	15.85	15.00	14.96	2.83
Post-test II	22.90	25.15	21.70	23.55	4.50
Ret. test I	14.57	15.15	15.50	14.98	2.85
Ret. test II	22.38	22.35	22.90	22.47	5.16

Table 9. Means, weighted means, and weighted standard deviations of variables in treatments IB, IIB, and V, Iowa State

Variable	Treatment mean IB	IIB	V	Combined treatment mean	st. dev.
Pretest I	15.55	15.51	15.63	15.55	2.68
Pretest II	21.85	22.25	21.80	21.99	4.29
GPA	2.64	2.69	2.53	2.64	0.58
ACT score	24.57	25.29	24.35	24.79	3.70
Post-test I	15.92	15.84	13.85	15.44	2.83
Post-test II	26.83	26.94	21.40	25.68	5.26
Ret. test I	15.55	15.79	14.42	15.39	3.22
Ret. test II	25.31	26.09	22.17	24.91	5.12

Table 10. Means, weighted means, and weighted standard deviations of variables in treatments IB, IIB, and V, Winona

Variable	Treatment mean IB	IIB	V	Combined treatment mean	st. dev.
Pretest I	15.90	15.65	15.60	15.75	2.42
Pretest II	19.62	19.85	22.00	20.18	3.45
GPA	2.63	2.74	2.79	2.70	0.48
ACT score	20.62	21.45	23.10	21.43	4.62
Post-test I	14.86	15.05	15.00	14.96	2.83
Post-test II	23.57	24.45	21.70	23.55	4.50
Ret. test I	15.14	14.55	15.50	14.98	2.85
Ret. test II	21.24	23.55	22.90	22.47	5.16

Analysis of Variance

Analysis of variance was used to compare the group means of the covariates and the measuring instruments.

Test of hypothesis I

I. Ho: There is no significant difference among the means of treatment groups as to pretest I scores, pretest II scores, ACT scores, college GPA, post-test I scores, post-test II scores, retention test I scores, and retention test II scores.

The difference between the means of treatment groups at Iowa State (Table 11) were highly significant for post-test I, post-test II, and retention test II. There was no significant difference between the means of the other variables.

The difference between the means of treatment groups at Winona State (Table 12) were significant for college GPA between original treatment groups (I through V) and between groups when grouping was by cartoons, IA, IIA, and V. The differences between the means of treatments grouped by cartoons were also significant for ACT scores. The rest of the differences between variable means were non-significant.

Table 11. Values of F from analysis of variance test for combinations of variables and treatment groups, Iowa State

Variable	Treatment group I, II, III, IV, V[a]	IA, IIA, V[b]	IB, IIB, V[b]
Pretest I	<1	<1	<1
Pretest II	1.47	2.56	<1
GPA	<1	<1	1.04
ACT score	1.55	<1	1.05
Post-test I	4.34**	8.74**	8.76**
Post-test II	10.27**	20.63**	20.61**
Ret. test I	2.06	2.35	2.46
Ret. test II	4.20**	7.94**	8.37**

[a]Degrees of freedom 4 and 178.

[b]Degrees of freedom 2 and 180.

**Significant at the .01 level.

Table 12. Values of F from analysis of variance test combinations of variables and treatment groups, Winona

Variable	Treatment group I, II, III, IV, V[a]	IA, IIA, V[b]	IB, IIB, V[b]
Pretest I	<1	<1	<1
Pretest II	1.56	2.91	1.82
GPA	2.95*	4.07*	<1
ACT score	2.49	4.60*	<1
Post-test I	1.06	2.05	<1
Post-test II	1.29	2.47	1.26
Ret. test I	<1	<1	<1
Ret. test II	<1	<1	1.07

[a]Degrees of freedom 4 and 46.

[b]Degrees of freedom 2 and 48.

*Significant at the .05 level.

Analysis of Covariance

The amount of variance that was accounted for was indicated by the squared multiple correlation coefficient (Tables 13, 14, 15, 16, 17, and 18). The use of all four covariates accounted for the largest amount of variance with all measuring instruments although with post-test II scores and in most cases for retention test II scores there was no measurable decrease in the amount of variance accounted for when pretest II was deleted as a covariate. At Iowa State post-test II and retention test II each accounted for a much larger percent of the variance than did post-test I or retention test I. At Winona State post-test II accounted for the largest percent of the variance with retention test II accounting for the least amount of variance.

Table 13. Values of R^2 for combinations of dependent variables and deleted covariates for treatment group I-V, Iowa State

Dependent variable	All	None	Covariate deleted ACT score	GPA	Pretest I	Pretest II
Post-test I	.089	.278	.275	.276	.278	.115
Post-test II	.188	.596	.584	.582	.386	.596
Ret. test I	.044	.179	.173	.176	.176	.094
Ret. test II	.086	.481	.433	.475	.339	.479

Table 14. Values of R^2 for combinations of dependent variables and deleted covariates for treatment group I-V, Winona

Dependent variable	All	None	Covariate deleted ACT score	GPA	Pretest I	Pretest II
Post-test I	.001	.279	.223	.264	.261	.071
Post-test II	.050	.499	.464	.450	.362	.499
Ret. test I	.017	.314	.314	.301	.313	.018
Ret. test II	.043	.209	.177	.210	.152	.209

Table 15. Values of R^2 for combinations of dependent variables and deleted covariates for treatment group IA, IIA, and V, Iowa State

Dependent variable	All	None	Covariate deleted ACT score	GPA	Pretest I	Pretest II
Post-test I	.089	.276	.273	.275	.276	.114
Post-test II	.186	.595	.584	.582	.379	.595
Ret. test I	.025	.169	.164	.165	.164	.074
Ret. test II	.081	.476	.429	.470	.329	.475

Table 16. Values of R^2 for combinations of dependent variables and deleted covariates for treatment group IA, IIA, and V, Winona

Dependent variable	All	None	Covariate deleted ACT score	GPA	Pretest I	Pretest II
Post-test I	.079	.314	.271	.288	.289	.125
Post-test II	.093	.501	.464	.448	.362	.501
Ret. test I	.017	.314	.314	.297	.312	.019
Ret. test II	.002	.204	.163	.202	.136	.203

Table 17. Values of R^2 for combinations of dependent variables and deleted covariates for treatment group IB, IIB, and V, Iowa State

Dependent variable	All	None	Covariate deleted ACT score	GPA	Pretest I	Pretest II
Post-test I	.089	.276	.273	.275	.276	.115
Post-test II	.186	.591	.579	.578	.379	.591
Ret. test I	.027	.169	.164	.166	.164	.074
Ret. test II	.085	.475	.427	.469	.328	.474

Table 18. Values of R^2 for combinations of dependent variables and deleted covariates for treatment group IB, IIB, and V, Winona

Dependent variable	All	None	Covariate deleted ACT score	GPA	Pretest I	Pretest II
Post-test I	.001	.279	.223	.264	.261	.071
Post-test II	.050	.499	.464	.450	.362	.499
Ret. test I	.017	.314	.314	.301	.313	.018
Ret. test II	.043	.209	.177	.210	.152	.209

In the experiment at Iowa State there existed a highly significant correlation (Table 19) between the following pairs of variables, one of which is underlined: (a) pretest I and post-test I and retention test I; (b) pretest II and GPA, ACT score, post-test II, and retention test II; (c) GPA and post-test II and retention test II; (d) ACT score and post-test II and retention test II; (e) post-test I and post-test II, retention test I, and retention test II; (f) post-test II and

Table 19. Correlation matrix for variables in treatment groups at Iowa State[a]

Variable		Covariates: Pretest I	Pretest II	GPA	ACT score	Measuring instruments: Post-test I	Post-test II	Ret. test I
		1	2	3	4	5	6	7
Pretest I	1	1.000						
Pretest II	2	.094	1.000					
GPA	3	.175*	.207**	1.000				
ACT score	4	.033	.422**	.471	1.000			
Post-test I	5	.418**	.084	.180*	.122	1.000		
Post-test II	6	.083	.607**	.348**	.443**	.209**	1.000	
Ret. test I	7	.334**	.159*	.193*	.170*	.434**	.147	1.000
Ret. test II	8	.028	.560**	.326**	.508**	.216**	.742**	.207**

[a]Degrees of freedom 181.

*Significant at the .05 level.

**Significant at the .01 level.

retention test II; (g) retention test I and retention test II.

A significant correlation existed at Iowa State between the following pairs of variables: (a) pretest I and GPA; (b) pretest II and retention test I; (c) GPA and post-test I and retention test I; (d) ACT score and retention test I.

In the experiment at Winona State there existed a highly significant correlation (Table 20) between the following pairs of variables, one of which is underlined: (a) pretest I and post-test I and retention test I; (b) pretest II and ACT score, post-test II, and retention test II; (c) GPA and ACT score and post-test II; (d) ACT score and post-test II and retention test II; (e) post-test I and retention test I; post-test II and retention test II.

Test of hypotheses II and III

II. Ho: There is no significant difference in learning among treatment groups receiving the information via television and those not receiving the information, the control group, when the initial difference between groups is statistically adjusted.

III. Ho: There is no significant difference in retention among treatment groups receiving the information via television and those not receiving the information, the control group, when the initial difference between groups is statistically adjusted.

Table 20. Correlation matrix for variables in treatment groups at Winona[a]

Variable		Covariates: Pretest I (1)	Pretest II (2)	GPA (3)	ACT score (4)	Measuring instruments: Post-test I (5)	Post-test II (6)	Ret. test I (7)
Pretest I	1	1.000						
Pretest II	2	.044	1.000					
GPA	3	.222	.207	1.000				
ACT score	4	.033	.422**	.470**	1.000			
Post-test I	5	.467**	-.010	.116	.121	1.000		
Post-test II	6	.103	.441**	.397**	.443**	-.029	1.000	
Ret. test I	7	.532**	.023	.005	.170	.363**	-.029	1.000
Ret. test II	8	.015	.356**	.140	.508**	.018	.398**	-.076

[a]Degrees of freedom 48.

**Significant at the .01 level.

The analysis of covariance of treatment groups at Iowa State (Tables 21, 23, and 25) resulted in a highly significant difference between treatment means, when all covariates were used, for each of the measuring instruments and within each of the treatment groups. At Winona State (Tables 22, 24, and 26) there was a highly significant difference between the treatment means, when all covariates were used, when measured by post-test II and a significant difference was shown when the measuring instrument was retention test I. These same results existed for all treatment groupings. For treatment group IA, IIA, and V there was a significant difference when the measuring instrument was post-test I.

Comparison of Non-Control Treatment Groups

A comparison of the four treatment groups which had observed the video tapes was made by means of analysis of covariance to determine if there existed a difference between the treatment means. The same four covariates were still used.

In the experiment at Iowa State there existed a highly significant correlation (Table 27) between the following pairs of variables, one of which is underlined: (a) pretest I and post-test I and retention test I; (b) pretest II and GPA, ACT score, post-test II, and retention test II; (c) GPA and ACT score, post-test II, and retention test II; (d) ACT score and post-test II and retention test II; (e) post-test I and

Table 21. Values of F from analysis of covariance test for combinations of dependent variables and related covariates, treatment group I-V, Iowa State

Dependent variable	Covariate deleted					
	All[a]	None[b]	ACT score[c]	GPA[c]	Pretest I[c]	Pretest II[c]
Post-test I	5.35*	8.36**	<1	<1	<1	39.22**
Post-test II	20.20**	32.06**	5.03*	5.81*	90.25**	<1
Ret. test I	2.35	4.76**	1.45	<1	<1	18.17**
Ret. test II	7.23**	20.12**	15.87**	2.00	47.26**	<1

[a]Degrees of freedom 4 and 178.

[b]Degrees of freedom 4 and 174.

[c]Degrees of freedom 1 and 175.

*Significant at the .05 level

**Significant at the .01 level.

Table 22. Values of F from analysis of covariance test for combinations of dependent variables and related covariates, treatment group I-V, Winona

Dependent variable	Covariate deleted					
	All[a]	None[b]	ACT score[c]	GPA[c]	Pretest I[c]	Pretest II[c]
Post-test I	1.30	2.44	2.43	1.45	1.57	11.73**
Post-test II	2.13	5.29**	2.74	4.22*	11.74**	<1
Ret. test I	<1	2.67	<1	<1	<1	17.77**
Ret. test II	<1	1.61	2.28	<1	3.59	<1

[a]Degrees of freedom 4 and 46.

[b]Degrees of freedom 4 and 42.

[c]Degrees of freedom 1 and 43.

*Significant at the .05 level.

**Significant at the .01 level.

Table 23. Values of F from analysis of covariance test for combinations of dependent variables and related covariates, treatment group IA, IIA, and V, Iowa State

Dependent variable	Covariate deleted					
	All[a]	None[b]	ACT score[c]	GPA[c]	Pretest I[c]	Pretest II[c]
Post-test I	5.38*	116.20**	<1	<1	<1	39.43**
Post-test II	20.28**	43.17**	4.94*	5.93*	94.31*	<1
Ret. test I	1.35	5.95**	1.01	<1	1.02	20.03**
Ret. test II	6.81*	26.65**	15.81**	2.11	49.51**	<1

[a]Degrees of freedom 2 and 180.

[b]Degrees of freedom 2 and 176.

[c]Degrees of freedom 1 and 177.

*Significant at the .05 level.

**Significant at the .01 level.

Table 24. Values of F from analysis of covariance test for combinations of dependent variables and related covariates, treatment group IA, IIA, and V, Winona

Dependent variable	Covariate deleted					
	All[a]	None[b]	ACT score[c]	GPA[c]	Pretest I[c]	Pretest II[c]
Post-test I	1.27	3.36*	2.80	1.68	1.62	12.15**
Post-test II	2.05	7.36**	3.28	4.71*	12.30**	<1
Ret. test I	3.73	3.36*	<1	1.08	<1	18.94**
Ret. test II	<1	1.88	2.26	<1	3.73	<1

[a]Degrees of freedom 2 and 48.

[b]Degrees of freedom 2 and 44.

[c]Degrees of freedom 1 and 45.

*Significant at the .05 level.

**Significant at the .01 level.

Table 25. Values of F from analysis of covariance test for combinations of dependent variables and related covariates, treatment group IB, IIB, and V, Iowa State

Dependent variable	Covariate deleted					
	All[a]	None[b]	ACT score[c]	GPA[c]	Pretest I[c]	Pretest II[c]
Post-test I	5.39*	13.32**	<1	<1	<1	39.37**
Post-test II	20.08**	48.63**	5.60*	5.93*	94.31**	<1
Ret. test I	1.41	6.96**	<1	<1	<1	20.06**
Ret. test II	7.13**	26.39**	16.06**	2.11	49.14**	<1

[a]Degrees of freedom 2 and 180.

[b]Degrees of freedom 2 and 176.

[c]Degrees of freedom 1 and 177.

*Significant at the .05 level.

**Significant at the .01 level.

Table 26. Values of F from analysis of covariance test for combinations of dependent variables and related covariates, treatment group IB, IIB, and V, Winona

Dependent variable	Covariate deleted					
	All[a]	None[b]	ACT score[c]	GPA[c]	Pretest I	Pretest II[c]
Post-test I	<1	2.84	3.46	<1	1.14	12.75**
Post-test II	1.96	7.30**	3.04	4.33*	11.98**	<1
Ret. test I	<1	3.36*	<1	<1	<1	19.01**
Ret. test II	<1	1.94	1.77	<1	3.16	<1

[a]Degree of freedom 2 and 48.

[b]Degrees of freedom 2 and 44.

[c]Degrees of freedom 1 and 45.

*Significant at the .05 level.

**Significant at the .01 level.

Table 27. Correlation matrix for variables at Iowa State[a]

Variable		Covariates				Measuring instruments		
		Pretest		GPA	ACT	Post-test		Ret. test
		I	II		score	I	II	I
		1	2	3	4	5	6	7
Pretest I	1	1.000						
Pretest II	2	.014	1.000					
GPA	3	.165*	.235**	1.000				
ACT score	4	-.016	.394**	.517**	1.000			
Post-test I	5	.426**	.059	.138	.039	1.000		
Post-test II	6	.006	.571**	.367**	.426**	-.006	1.000	
Ret. test I	7	.357**	.168*	.206*	.057	.354**	.006	1.000
Ret. test II	8	.017	.599**	.320**	.449**	.099	.735**	.090

[a]Degrees of freedom 141.

*Significant at .05 level.

**Significant at .01 level.

retention test I; (f) post-test II and retention test II.

A significant correlation existed at Iowa State between the following pairs of variables: (a) pretest I and GPA; (b) pretest II and retention test I; (c) GPA and retention test I.

In the experiment at Winona State there existed a highly significant correlation (Table 28) between the following pairs of variables, one of which is underlined: (a) pretest I and post-test I and retention test I; (b) pretest II and post-test II; (c) GPA and ACT score and post-test II; (d) ACT score and post-test II.

A significant correlation existed at Winona between the following pairs of variables: (a) pretest II and ACT score; (b) ACT score and post-test I and retention test I; (c) post-test I and retention test I; (d) post-test II and retention test II.

The amount of variance accounted for in each treatment grouping was indicated by the squared multiple correlation coefficients. At Iowa State (Table 29) post-test II and retention test II each accounted for a much larger percent of the variance than did post-test I or retention test I. At Winona State (Table 30) post-test II accounted for the largest percent of the variance with retention test II accounting for the least amount of variance.

Table 28. Correlation matrix for variables at Winona[a]

Variable		Covariates				Measuring instruments		
		Pretest		GPA	ACT	Post-test		Ret. test
		I	II		score	I	II	I
		1	2	3	4	5	6	7
Pretest I	1	1.000						
Pretest II	2	.282	1.000					
GPA	3	.245	.147	1.000				
ACT score	4	.220	.347*	.677**	1.000			
Post-test I	5	.418**	.076	.190	.328*	1.000		
Post-test II	6	.297	.416**	.540**	.575**	.115	1.000	
Ret. test I	7	.552**	.250	.016	.096	.317*	.183	1.000
Ret. test II	8	.100	.233	.245	.325*	.040	.365*	-.005

[a]Degrees of freedom 39.

*Significant at .05 level.

**Significant at .01 level.

Table 29. Values of R^2 for dependent variables in different treatment groups, Iowa State

Dependent variable	Treatment group I-IV	IA & IIA	IB & IIB
Post-test I	.191	.188	.188
Post-test II	.405	.403	.399
Retention test I	.183	.172	.172
Retention test II	.429	.424	.421

Table 30. Values of R^2 for dependent variables in different treatment groups, Winona

Dependent variable	Treatment group I-IV	IA & IIA	IB & IIB
Post-test I	.303	.301	.264
Post-test II	.455	.451	.449
Retention test I	.363	.331	.338
Retention test II	.188	.156	.159

The combined means and standard deviations (Table 31) for the four treatment groups which viewed the video tape, control group was not included, produced a gain in score when post-test II was compared to pretest II and at Iowa State when post-test I was compared to pretest I. At Winona State the comparison of post-test I with pretest I gave a decrease in scores.

Table 31. Combined means and standard deviations of variables in the four video treatment groups

Variable	Iowa State		Winona State	
	Mean	St. dev.	Mean	St. dev.
Pretest I	15.53	2.73	15.78	2.46
Pretest II	22.04	3.95	19.73	3.04
GPA	2.67	0.58	2.68	0.49
ACT score	24.92	3.72	21.02	4.68
Post-test I	15.88	2.50	14.95	2.88
Post-test II	26.88	4.49	24.00	4.44
Retention test I	15.66	2.94	14.85	2.68
Retention test II	25.68	4.88	22.37	5.39

Test of hypotheses IV, V, VI, and VII

IV. Ho: There is no significant difference in achievement, as measured by a post-test, of the groups of students taught by television when the video method of presentation is varied and the initial difference between groups is statistically adjusted.

V. Ho: There is no significant difference in retention, as measured by a retention test, of the groups of students taught by television when the video method of presentation is varied and the initial difference between groups is statistically adjusted.

VI. Ho: There is no significant difference in achievement, as measured by a post-test, between the combined groups when the video method of presentation remains constant and the initial difference between strata is statistically adjusted.

VII. Ho: There is no significant difference in retention, as measured by a retention test, between the combined groups when the video method of presentation remains constant and the initial difference between strata is statistically adjusted.

The comparison of the treatment means at Iowa State (Table 32) and at Winona State (Table 33) by means of covariance showed no significant difference between the treatment means for any of the groupings.

Table 32. Values of F from analysis of covariance test for dependent variables in different treatment groupings, Iowa State

Dependent variable	Treatment group I-IV[a]	IA & IIA[b]	IB & IIB[b]
Post-test I	<1	<1	<1
Post-test II	<1	1.19	<1
Retention test I	<1	<1	<1
Retention test II	<1	1.13	<1

[a]Degrees of freedom 3 and 135.

[b]Degrees of freedom 1 and 137.

Table 33. Values of F from analysis of covariance test for dependent variables in different treatment groupings, Winona

Dependent variable	Treatment group I-IV[a]	IA & IIA[b]	IB & IIB[b]
Post-test I	<1	1.95	<1
Post-test II	<1	<1	<1
Retention test I	<1	<1	<1
Retention test II	1.26	1.30	1.41

[a]Degrees of freedom 3 and 33.

[b]Degrees of freedom 1 and 35.

Stratified Grouping

The four video treatment groups were combined by the visuals seen, those having seen cartoons and those having seen questions and statements. Each group was then stratified by sex, college grade point average, level for which student was preparing to teach, and ACT scores.

The squared multiple correlation coefficients for various combinations of strata and measuring instruments for cartoon grouping and for question and statement grouping indicate the amount of variance accounted for (Tables 34 and 35). The greatest amount of variation was accounted for by post-test II and retention test II at Iowa State and by post-test II at Winona State.

Table 34. Values of R^2 for combinations of dependent variables and independent variables for the treatment groups IA and IIA

Dependent variable	Iowa State				Winona State	
	Sex	GPA	Teaching prep.	ACT score	Sex	GPA
Post-test I	.237	.208	.215	.231	.315	.360
Post-test II	.405	.423	.420	.424	.543	.511
Ret. test I	.241	.209	.227	.196	.345	.527
Ret. test II	.450	.460	.435	.451	.173	.324

Table 35. Values of R^2 for combinations of dependent variables and independent variables for the treatment groups IB and IIB

Dependent variable	Iowa State				Winona State	
	Sex	GPA	Teaching prep.	ACT score	Sex	GPA
Post-test I	.210	.197	.217	.271	.279	.389
Post-test II	.402	.432	.412	.424	.542	.549
Ret. test I	.235	.219	.235	.205	.345	.490
Ret. test II	.428	.426	.431	.435	.228	.408

Comparisons were then made between strata within the same treatment group and between the same strata in different treatment groups but within the same visual grouping.

Test of hypotheses VIII and IX

VIII. Ho: There is no significant difference in achievement, as measured by a post-test, between the stratified groups when the video method of presentation is varied and the initial difference between treatment groups is statistically adjusted.

IX. Ho: There is no significant difference in retention, as measured by a retention test, between the stratified groups when the video method of presentation is varied and the initial difference between treatment groups is statistically adjusted.

After the means had been statistically adjusted for the covariates there was found to be no significant difference between the means in any of the groupings (Tables 36 and 37) at either Iowa State or at Winona State.

Table 36. Values of F from analysis of covariance test for dependent variables in stratified treatment groups IA and IIA

Dependent variable	Iowa State[a]			Winona State[b]		
	Sex	GPA	Teaching prep.	ACT score	Sex	GPA
Post-test I	<1	<1	2.01	<1	<1	1.12
Post-test II	<1	<1	2.09	<1	<1	<1
Ret. test I	<1	<1	1	1.14	<1	<1
Ret. test II	<1	<1	1.09	<1	<1	<1

[a]Degrees of freedom 1 and 137.

[b]Degrees of freedom 1 and 35.

Table 37. Values of F from analysis of covariance test for dependent variables in stratified treatment groups IB and IIB

Dependent variable	Iowa State[a]			Winona State[b]		
	Sex	GPA	Teaching prep.	ACT score	Sex	GPA
Post-test I	<1	<1	1.10	3.01	<1	<1
Post-test II	<1	<1	<1	2.80	<1	<1
Ret. test I	<1	<1	<1	<1	<1	<1
Ret. test II	1.17	1.16	<1	<1	3.58	1.08

[a]Degrees of freedom 1 and 137.

[b]Degrees of freedom 1 and 35.

Summary

When the groups at Winona State were compared, a significant difference was observed in the unadjusted ACT scores and college grade point averages between treatment groups even though the students had been randomly assigned to the treatments.

Analysis of covariance was used to compare the treatment groups at both institutions, using pretest I and II scores, ACT scores, and college grade point averages as covariates. The students viewing the video tapes learned highly significantly more than the control group which did not receive the information. When the four treatment groups viewing the video tapes were compared there was no significant difference in the

adjusted means. The same results were observed when the treatment groups were combined by those viewing the cartoons and again by those viewing the statements and questions or when the groups were stratified and then compared.

There was a very low correlation between pretest I, post-test I, and retention test I, which were used to measure application of presented material, and pretest II, post-test II, and retention test II, which were used to measure recall of material presented.

The greatest amount of variance at Iowa State was accounted for with post-test II and retention test II. At Winona State the largest amount of variance was accounted for by post-test II and retention test I.

DISCUSSION

This study investigated the effect of visual changes on learning via television. The material used was relevant to the normal content of Education 204 at Iowa State University but was unrelated to the normal content of Education 304 at Winona State.

The material that was presented as the treatment was quite value ladened, religious and social. This may have inhibited learning because it might have been in contrast to the views of the particular student. It would be doubtful if attitudes and beliefs could be changed during such a short treatment period.

For the four video treatment groups at Iowa State the largest increase in the adjusted mean scores (Tables 5, 7, and 9), both post-tests and retention tests, occurred with treatment II lecturer plus questions and statements. The second increases were consistent for all four measuring instruments.

At Winona State the results were not consistent (Tables 6, 8, and 10). For all treatment groups there was a decrease in the unadjusted mean scores from pretest I to post-test I and retention test I scores and with one exception, treatment III, retention test I mean scores were equal to or higher than those for post-test I. Since the number of participants in each treatment group was relatively small (Table 2) these decreases may have been due to chance, but the consistency of

the change makes this explanation seem unlikely, although it may have been a contributing factor. Another reason may have been that the treatment material was not related to the course content, as it was at Iowa State. This would make the learning situation more unrealistic and affect the application of learned material to other situations. This was the effect that measuring instrument I was to measure.

Treatment III, cartoons, produced the largest increase for the unadjusted means for post-test II. Treatment I lecturer, produced a slightly larger increase for the unadjusted means for retention test II than did treatment III. While these results were not as consistent as at Iowa State, they were reasonable when compared to other published findings.

The comparison of the five video treatment groups at Iowa State University (Table 11), by analysis of variance, showed significant difference between the means of the measuring instruments. At Winona State College (Table 12), however, the only significant difference between group means were between college grade point averages in the original five treatments and also when grouped by cartoon visuals. There was also a significant difference between the ACT score means when grouping was by cartoons. This difference further exemplifies the need for use of analysis of covariance to eliminate possible non-treatment group differences. This difference existed at Winona State even though the students had been randomly assigned to the treatments. When this difference was eliminated

by analysis of covariance then there was a highly significant difference (Tables 22, 24 and 26) between treatment means as measured by post-test II for treatment groupings and a significant difference between treatment means as measured by retention test II for grouping of treatments by cartoons and by questions and statements. At Iowa State (Tables 21, 23, and 25) there existed a highly significant difference between the treatment means as measured by post-test I and II and retention test I and II, when all of the covariates were used.

When the control group, treatment V, was deleted and the treatments viewing the video tapes were compared, there was no significant difference (Tables 32 and 33) between their means when pretest I and II scores, ACT scores, and college grade point averages were used as covariates. There was still no significant difference when the treatments were compared after combining the treatment groups by those having seen cartoons and those not viewing cartoons and by those viewing questions and statements and by those not viewing questions and statements.

Examination of the stratified treatment groups (Tables 36 and 37), by sex, level of teaching preparation, college enrolled in, college grade point average, and ACT score, produced no significant difference either within the same treatment group or when the same strata was compared between treatment groups.

As indicated by the squared multiple correlation coefficient (Tables 13, 15, 17, 29 and 32), the greatest amount of variance at Iowa State was accounted for by use of post-test II and retention test II. This was not true at Winona State (Tables 14, 16, 18, 30 and 33) where retention test I accounted for more of the variance than did retention test II. The reason for this is not clear. The much smaller sample size used at Winona State may help to account for this difference.

The low correlation between measuring instruments I and II (Tables 19, 20, 27, and 28) indicate that it is possible to test the same material with tests which measure different types, or levels, of learning. Thus the amount of learning which is said to take place may to some degree be due to the type of measuring instrument that was used.

At Iowa State two of the sections, B and C, were told that the video tapes were part of a research project and that participation was optional. Thus the true representativeness of the samples from these sections may have been influenced by the fact that the participation was voluntary.

Unless the treatment material is an integral part of the material being presented to the learner it becomes an artificial setting. This is particularly true if the person presenting the treatment material is other than the instructor. If the treatment material was an integral part of the course it might help to reduce the wide variation which occurred in attendance.

It might also help to remove the feeling held by some instructors that they or their students were being imposed upon.

Conclusions

On the basis of the findings in this investigation, the following conclusions were drawn:

1. Television is an effective media by which learning can take place.
2. The use of visuals in place of the lecture had no significant effect on learning via television.
3. The insertion of relevant visual questions and statements had no significant effect on learning via television.
4. Stratas in stratified treatment groups tested, learned equally well when taught by television.
5. It is possible to prepare tests over the same material which test different types of learning.

Recommendation for Additional Research

The exploratory nature of this study offers only a tentative evaluation of the effect of visuals on learning via television. To substantiate the findings of this investigation and to enlarge upon it, the following areas of research are suggested.

1. The study should be replicated with the experiment being an integral part of the course content and for a longer period of time.
2. The study should be replicated with all visuals being relevant to the audio portion versus all visuals being irrelevant.
3. A study to determine the effect of visuals on learning by high speed audio should be carried out.
4. A study to determine the effect on learning of inserted visual questions and statements independent of each other should be carried out.
5. A study to determine the effect of visuals on learning in different subject areas should be carried out.

SUMMARY

This study compared the effectiveness of different visual sequences on learning via television. These visual sequences consisted of: (a) visuals of the speaker, (b) visuals of speaker plus inserted questions and statements, (c) visuals consisting of pictures, drawings, and cartoons, and (d) visuals consisting of pictures, drawings, and cartoons plus related questions and statements.

Purpose

The purpose of the study was to obtain evidence which would aid in the answering of the following questions:

1. Why does the comparison of learning via television and the traditional method often result in apparent contradictory results?
2. Does change in the visual channel of television affect learning and/or retention?
3. Does change in the visual channel of television affect learning and/or retention when treatment groups are stratified by college major, level of teaching preparation, sex, college grade point average, or ACT score?
4. Can learning via television be increased by inserting visual reinforcement statements and related thought questions?

Experimental Procedure

To investigate problem areas mentioned earlier a learning experiment was conducted which involved 183 students taking Education 204 at Iowa State University. The same experiment was repeated with 51 students in Education 304 at Winona State College.

The study consisted of five treatment groups, four of which received the information via video tapes and the fifth which was a control group and did not receive the information. The four treatment groups all received the same audio but each video was as follows: (a) in treatment I the visual was the speaker, (b) treatment II consisted of visuals of the speaker plus visuals containing statements and questions which were related to the material being presented, (c) treatment III consisted of visuals using slides of cartoons and drawings, and (d) treatment IV consisted of visuals using slides of cartoons and drawings plus visuals of relevant statements and questions.

A comparison was first made of the homogeneity of the various groups by means of analysis of variance. For the rest of the comparisons, analysis of covariance was used to alleviate possible initial differences between treatment groups as to pretest I and II scores, ACT scores, and college grade point averages.

To determine the effect of the cartoons and slides and of the statements and questions inserted, the original four treatment groups were recombined into two groups, those not viewing the cartoons and slides, treatments I and II, and those which did view the cartoons and slides, treatments III and IV. And, as a second combination, those viewing the statements and questions, treatments I and III and those not viewing the statements and questions, treatments II and IV. Treatment V was the control group.

A second comparison was made using only the four treatment groups which had viewed the video tapes.

A further insight into the effect of the visuals was obtained by stratifying the combined treatment groups as to sex, college grade point average, ACT score, level of teaching preparation, college in which enrolled and then repeating the above comparisons.

At Iowa State University the students were assigned to the sections by registrar and the treatments assigned to the sections by means of a table of random numbers. At Winona State College the students were assigned to the treatment group by means of a table of random numbers.

Results

In evaluating the effectiveness of the effect of visuals on learning via television, differences in mean score of post-test and retention test were compared after first being

adjusted for pretest scores, college grade point averages, and ACT scores. The results of the statistical test were:

1. Hypothesis 1 was rejected. There was a significant difference among the unadjusted variable means among treatment groups.
2. Hypothesis 2 was rejected. Students viewing the video tapes learned significantly more than those not viewing the video tapes.
3. Hypothesis 3 was rejected. Students viewing the video tapes retained significantly more at the end of six weeks than did those students not viewing the video tapes.
4. Hypotheses 4 through 9 were not rejected. There was no significant difference found among treatment or strata means of those students viewing the video tapes, as measured by post-test I or II or in the amount of material retained at the end of six weeks as measured by retention test I or II, after the initial difference was adjusted for pretest I and II scores, college grade point average, and ACT scores.

There was no attempt made to complete comparisons between schools because of the apparent differences in populations.

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APPENDIX I. EXCERPTS FROM TEXT OF VIDEO TAPES

One of the primary purposes of the visuals was an attempt to maintain student interest. What the viewer perceived from the visuals depended on his past experiences and the particular "mood" which the viewer was in at the time of viewing. In order to try and encompass as large a percent of the viewers as possible the visuals ranged from those in which there was a clear relationship to the audio portion to those in which there was an abstract relationship. Statements and questions (i.e., R8A) replaced the respectively numbered visual (i.e., R8) on video tape number III and replaced the speaker on video tape I. The following are excerpts from each of the three video tapes.

The visuals were copied with permission from the following sources:

Addams, Charles. Homebodies. Simon and Shuster. New York. 1954.

a. Visual I60. p 74.

Darling, J. M. Education of Alonzo Applegate. Register and Leader. Des Moines, Iowa. 1910.

a. Visual S41. The education of Alonzo Applegate, No. 10. p 58.

b. Visual I59. Revising the tariff downward. p 12.

Darling, J. N. Cartoons from the files of the Register and Leader. Register and Leader. Des Moines, Iowa. 1909.

a. Visual R7. What the poet meant when he wrote: "The melancholy days have come, the saddest of the year". p 50.

b. Visual R9. When we get the streets cleaned up why not clean up the sidewalk. p 46.

c. Visual R10. Uncle Sam's puzzles how to separate the two without breaking anything. p 12.

d. Visual I58. Elastic currency. p 58.

Darling, J. N. In peace and war cartoons. The Register and Tribune Co. Des Moines, Iowa. 1916.

a. Visual R8. We advocate the establishment by the government of target practice for coal heavers. p 99.

b. Visual S42. Partners in crime. p 2.

Murrell, William, A history of American graphic humor (1865-1938). Reprinted by Whitney Museum of American Art, New York. Macmillan Co. New York. 1938.

a. Visual S40. Keller, F. The modern messiah. The Wasp. San Francisco 1881. Collection of Mr. Harry MacNeill Bland.

b. Visual S43. Newell, P. A complaint. circa 1895.

c. Visual I61. Glackens, L. M. In prehistoric Germany. Puck April 24, 1907.

The following are excerpts of the material presented on each of the three video tapes. The visuals are presented in order to give further insight into their relationship with the audio portion.

Religious Effect on Education

[R7] Because the school can not cater to all influences that are exerted on it, it must be derived through an ordered system or a potpourri of choices. [R8][R8A] When the choice is based on reason then it must be done in accord with some system of preference or else it becomes a hodgepodge marked by fads and whims.

R7

R8

WHAT WOULD BE YOUR PRIMARY PREFERENCE?

R8A

[R9] Parents, businessmen, religious leaders and politicians have helped to make curriculum decisions throughout history. After the rise of nationalism, governments became directly concerned with what the curriculum contained. [R10] Governments substantiated their concern through financial aids and by issuing fiats. Legislatures issued broad mandates such as the Northwest Ordinance of 1787 which directed that education be encouraged and made valuable resources available.

R9

R10

Social Effect on Education

[S40] The present concerns of the school center around the minority groups and are due, in part, to the desire for social informalities of the students of the different ethnic groups and the removal of social barriers and discriminations as they exist in segregated schools.

S40

[S41] In some societies there exists a desire for a product of education that so perpetuates society that it requires particular types of courses. This type of influence on the curriculum reaches its peak in times of [S42] [S42A] uncertainty and anxiety. This occurs to the greatest extent in Christian and race grouped societies.

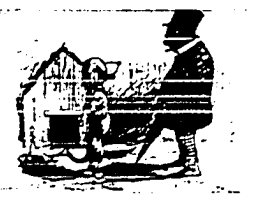
S41

S42

WHAT IS THE SOCIAL EFFECT AT THE PRESENT TIME?

S42A

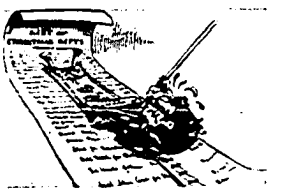
[S43] As long as there exists differences between ideals such as social movement and equality of groups on one hand and the perception of the reality of unequality on the other hand then society will direct its influence on education.



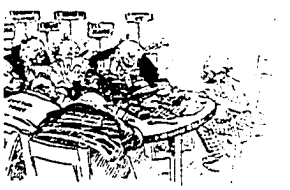
S43

Industrial Effect on Education

[I58] The influence of the industrial system is seen in the large financial aid given to colleges and universities by industry in the form of science and mathematical grants and the small amount of financial aid which industry gives to the fine arts area. [I59] [I59A] In order for a balance to be maintained in the area of education there must be a compromise between liberal education and those areas of interest to industry. [I60] The college and university community needs to retain permanent authority for the education which it provides and for the research which undertakes. [I61] The needs of the industrial system must always be secondary to the cultivation of general understanding and perception. Before this can occur educational institutions need to regain control of their own budget.



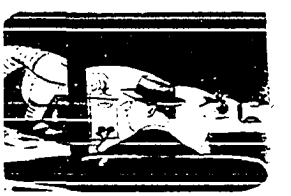
I58



I59

INDUSTRY GIVES FINANCIAL AID IN AREAS THAT ARE OF INTEREST TO THEM.

I59A



I60

I61

APPENDIX II. MEASURING INSTRUMENTS

Post-test I

The following are summaries of school objectives or newspaper articles. Using the information from the tapes place the appropriate letter in front of the statement that corresponds to the probable cause of each. There is only one best answer for each question.

Use answer sheet I.

A. Religion
B. Social
C. Industrial
D. Others

1. To understand courtship and its relationship to marriage.
2. Junior college plans to help retrain cement plant workers who were laid off due to mechanization.
3. To know about our government: local, state and federal.
4. School deletes Christmas pageant at request of minority group.
5. To understand the heritage of America.
6. The Des Moines School Board reversed its original decision to transfer 15 students from Hubbell to Elmwood school because of over crowded conditions. They are now given choice as to a change or not.
7. Professor of medical psychology says driver's education is a waste of time and money.
8. To promote good business habits.
9. To obtain appropriate sex education.
10. To develop tolerance and open-mindedness.
11. To provide vocational training.
12. To learn obedience.
13. To acquire obedience.
14. A Grinnell College student is facing disciplinary action because a girl stayed five days in his dormitory room.
15. To understand the establishment of a successful marriage.

16. To learn proper library usage.
17. To form wholesome attitudes and practices toward dating.
18. To know the advantages of buying name brands.
19. To develop poise, tact, and self-confidence.
20. To learn to drive a car safely.
21. Trial continues on alleged spanking of third grade student by teacher.
22. To understand the job opportunities in nursing.
23. Instructor hired for teaching of exceptional children approved by board action.
24. To lead a worthy life.
25. State receives Title III funds for education.

Post-test II

From the information given on the tape answer the following questions by blacking in between the appropriate lines on the answer sheet. There is only one best answer for each question.

Use answer sheet II.

1. Which of the following is least likely to be a goal of social education?
   a. prepare for the status quo.
   b. to mold the pupil for a preconceived society.
   c. to prepare the pupil for cooperative social planning.
   d. to develop the intellect.

2. Which of the following is probably not a behavior objective of the social curriculum?
   a. wear acceptable dress.
   b. abide by group decisions.
   c. express emotions constructively.
   d. obtain a college education.

3. Education's main goal in the 1800's was to develop
   a. cultural appreciation.
   b. political interest.
   c. individual reliance.
   d. economic growth.

4. A school built on the claims of society would not be likely to offer
   a. course in drivers training.
   b. home economics.
   c. sex education.
   d. philosophy.

5. Special orders of the Catholic Church, such as the Brethern of Christianity, were established in 1602
   a. to lead religion in the new world.
   b. to be missionaries in the new world.
   c. to be educators in the new world.
   d. to form churches in the new world.

6. The power of our country at the turn of the century was in the hands of
   a. churches.
   b. government.
   c. land owners.
   d. industries.

7. Industrial leaders of the past
   a. guided their corporations.
   b. were figure-heads.
   c. relied on group decision.
   d. were educators.

8. Democracy has as its base
   a. freedom for all.
   b. religious heritage.
   c. oppression of our forefathers.
   d. anarchy.

9. Religious and moral ethics of the early French settlers were influenced by the
   a. Jesuits.
   b. Lutherans.
   c. French Hugenots.
   d. Dutch.

10. The early 1800;s could be called the time of
   a. the self made man.
   b. large industrial systems.
   c. stagnation of population.
   d. urban movement and growth.

11. Religious oriented curriculum may lead to
    a. a broad background
    b. non-sectarian presentation.
    c. elimination of material at odds with the church.
    d. no major difference in public curriculum.

12. World War II brought emphasis in the United States on
    a. dissension.
    b. mistrust.
    c. teamwork.
    d. individual ability.

13. The basic textbook in the elementary Protestant school was
    a. McGuffey's Reader.
    b. the teacher.
    c. the Bible.
    d. the classics.

14. Industry of today relies on decisions made by
    a. its leaders.
    b. specialists.
    c. society.
    d. economy.

15. If survival is accepted as a test then many of our social customs and traditions are
    a. desirable.
    b. unique.
    c. invalid.
    d. trivial.

16. The curriculum of the Catholic schools was
    a. similar to that of the Protestant schools.
    b. more deeply religious.
    c. had little singing.
    d. ritual.

17. The mid-forties brought change in industrial decision making in the form of
    a. new leaders.
    b. monopolies.
    c. group decisions.
    d. conglomerates.

18. Formal education from a society aspect consists of
    a. intellectual prowess.
    b. ideology of the community.
    c. faith in learning.
    d. growth of knowledge.

19. The change of industrial leaders from being financial leaders to leading scientists or college presidents indicates stress on
    a. education.
    b. technology.
    c. skilled workers.
    d. capital.

20. Industry influences education through
    a. politics
    b. financial help.
    c. leadership.
    d. research.

21. In the early 1800's, unsettled land in the United States was
    a. sparse.
    b. abundant.
    c. desert.
    d. undesirable.

22. The power of our country is now in the hands of
    a. churches.
    b. government.
    c. land owners.
    d. industries.

23. Elementary and secondary schools omit formal religious classes because of pressure form
    a. minority groups.
    b. the church.
    c. society.
    d. educators.

24. Industries of the past projected personalities of their
    a. society.
    b. educators.
    c. leaders.
    d. politicians.

25. From the social aspect, society's chief concern is its
    a. value.
    b. perpetuation.
    c. movement.
    d. morals.

26. Social curriculum emphasizes
    a. social evolution.
    b. religious cults.
    c. social adjustment.
    d. social industries.

27. The early Protestant schools
    a. taught for the good life of the individual.
    b. taught for individual interpretation.
    c. taught the individual how to think.
    d. taught the individual what to think.

28. The success of a new car type can usually be attributed to
    a. high national economy.
    b. company planning.
    c. company name.
    d. type of car.

Blacken in the mark for A if the statement is true and the mark for B if the statement is false.

29. The social claim on the curriculum is greatest in the Messianic society.

30. Present pressures by minority groups on schools are for more socialization of their students.

31. The school is obligated to fill all claims on the curriculum.

32. The market promises money for the business firms.

33. The chief method of the early schools was truth and facts.

34. Customs and ideas seldom outlive their usefulness.

35. Protestants were persecuted in England by the Roman Catholics.

36. The social perspective of man converges on human groups.

37. The corporation lends adaptability to the organization.

38. Planning of production is separate from the selling cycle.

39. Social groups work toward the good of man as its end product.

40. Abundant natural resources in the United States was the main reason for the early pioneer to be a "self-made" man.

41. Religion is taught in most public universities.

APPENDIX III. CODING FOR CARD PUNCHING

Column no.	Information	Range
0-10	social security number	
11,12	post-test I score	0-25
13,14	post-test II score	0-41
15	college grade point group	1-5
16	ACT score group	1-5
17	sex 1-2	1-2
18	number of courses taken by TV	1-3
19	college major	1-4
20	level of teaching preparation	1-3
21,22	treatment, each college	1-10
23	treatment, both colleges	1-6
24	visual seen, each college	1-6
25	visual seen, both colleges	1-3
26	questions and statements, each college	1-6
27	questions and statements, both colleges	1-3
28	school	1-2
29	schools combined	1
30,31	pretest I score	0-25
32,33	pretest II score	0-41
34,35	retention test I score	0-25
36,37	retention test II score	0-41
38-42	college grade point average	0.-4.
43-44	ACT score	0-40

Video treatment

Trt. no.	Treatment	Sec.	Time	Code no.
I	lecturer	G	8:00	1
II	lecturer plus questions and statements	C	2:00	2
III	cartoons	B	11:00	3
IV	cartoons plus questions and statements	A	9:00	4
V	none	I	3:00	5

College prep.

Code no.	Col.
1	Education
2	Home Economics
3	Agriculture
4	Science and Humanities

Combined treatments

Trt. no.	Trt.	Code no.
IA	I & II	1
IIA	III & IV	2
IB	I & III	1
IIB	II & IV	2

ACT group

Code no.	Range
1	19.89
2	19.89-23.55
3	23.56-27.24
4	27.25-30.91
5	30.91

GPA group

Code no.	Range
1	2.30
2	2.30-2.59
3	2.60-2.99
4	2.99

Sex group	
Sex	Code no.
Male	1
Female	2

School	
School	Code no.
I. S. U.	1
Winona	2

Level of teach. prep.	
Level	Code no.
Elem.	1
Sec.	2
Other	3

Visuals each college	
Trt. no.	Code no.
IB	1
IIB	2
V	3

Quest. and st. each college	
Trt. no.	Code no.
IA	1
IIA	2
V	3

Trt. both schools	
Trt. no.	Code no.
I	1
II	2
III	3
IV	4
V	5
IA	6
IIA	7
IB	8
IIB	9